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# West Europe Report

SCIENCE AND TECHNOLOGY

No. 61

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WEST EUROPE REPORT  
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## ELECTRONICS

### GOVERNMENT-AIDED UK FIRM COMPETES FOR MICROCHIP MARKET

Duesseldorf WIRTSCHAFTSWOCHEN in German 3 Apr 81 pp 116-119

[Article: "Microchips--Ideas Unlimited"]

[Text] With government funds of 50 million pounds, a company has been established in Great Britain which plans to catch up with the Americans and Japanese in the market for microchips. The kick-off campaign will begin in Germany.

In Munich or Stuttgart, Immos International Ltd. will in the near future offer to a select customer group their first product, a crystal wafer covered with 16,000 memory cells, each consisting of a transistor, a condenser and numerous auxiliary circuits. The introduction of the microchips in Germany is the start of an aggressive marketing campaign which will be expanded to cover all of Europe.

Just 3 years ago there was no such firm as Immos in Bristol. Microelectronics was at that time still--but not so much today--almost exclusively the domain of the Americans and Japanese. In mid-1978, however, the then Labour Government decided that Great Britain should also have a part in such a promising future market. In July 1980 even the market-economy apostle and enemy of government subsidies, Conservative Minister of Industry Sir Keith Joseph, was persuaded to invest the second 25-million-pound appropriation of tax money in the undertaking which he had earlier labeled as a "potentially expensive failure."

Today, 9 months later there is an Immos and more confident than ever. Immos spokesman Dick Selwood says: "Our ambition is still to be the leading business in the field of integrated microelectronic circuits." If Selwood can be believed, his firm now offers as a "world's first" mass-produced microchips of the 16 K RAM (Random Access Memory) type. Considered as customers for the chips, at a price of about \$100 a piece, are computer builders, the telecommunications sector and manufacturers of scientific equipment.

From all appearances, the newcomer has been successful in significantly reducing the usually high rejection rate of about 90 percent resulting from the complicated manufacturing processes. Immos equips the chips from the start with an excess of memory cells which can replace the faulty cells. Also, for the next generation of microchips, silicon wafers with 64 K RAMs (64,000 memory cells), Immos feels thoroughly equipped. Until now the Immos chips have come exclusively from a factory in Cheyenne Mountain,

Colorado, where about 400 workers are employed. A factory is being built in the vicinity of the South Wales city of Gwent, which will go into operation in the summer of 1982, employing about 1,000 workers who will primarily build microcomputers.

By 1984 Inmos expects to achieve an annual sales of about 200 million pounds with 4,000 workers. Sixty percent of the manufacturing will be done in England and the remainder primarily in the United States. By 1982 or 1983 the company expects to realize its first profits.

The electronics neophyte from Bristol confidently rejects the doubt of the skeptics that Inmos will not be able to gain a foothold in a market where electronic giants like Intel, Motorola, Fairchild, Texas Instruments and others are already established. They point to an independent American study which holds out good chances for newcomers into the rapidly growing market. Just in the case of the 64 K RAM, a market volume of over \$ 1 billion per year by 1985 is projected.

The self-confident of Inmos rests primarily on the fact that they have attracted several of the leading figures in international microelectronics. President and principal business manager of the firm is the 58-year-old American Richard L. Petritz, who spent 10 years with Texas Instruments where he, among other things, directed the research division. He was also involved in founding the U.S. microchip firm Mostek in 1969.

The number two man at Inmos, Paul R. Schroeder, 40, was for some time at Mostek and is considered--as is also the third cofounder of Inmos, the Briton Iann Barron, 44--to be an authority in the field of microelectronics. In the fall of 1978, Mostek tried in vain via court action to prevent Schroeder and others from carrying business secrets to the British competition.

During the founding of Inmos, several Labour representatives raised the issue that the government with its dedicated 50 million pounds of state aid would enable Petritz and his men to become millionaires. The national business holding company, the National Enterprise Board (NEB), holds only 72 percent of the shares of Inmos. The remainder is distributed to the 3 cofounders and leading personnel. After all, according to an Inmos prospectus, the founding triumvirate involves "men whose fund of ideas knows no limits"; and according to job advertisements, "persons of extraordinary talent" are being sought.

Seldom has a government offered such talented people such an opportunity to transform clearly promising theories into practice.

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CSO: 3102/250

## ELECTRONICS

### VLSI BRINGS NEW GENERATION OF SELF-TESTING CIRCUITS

Paris ELECTRONIQUE ACTUALITES in French 3 Apr 81 p 37

[Article by F. Grosvalet]

[Text] At the current stage of very large-scale integration [VLSI], a new generation of circuits containing a self-testing function is in the process of being born which should improve the circuit's safety margin against failures without greatly affecting its rapidity or total silicon surface requirement. Where a single chip contains as many as, and even more than, 100,000 transistors, the testing of circuits becomes not only an expensive operation but also a difficult one to carry out, and the integration, on the same chip, of a function enabling the circuit to test itself, even if it is costly in terms of silicon surface--from 10 to 100 percent additional, depending on the function to be performed and the degree of performance required--becomes viable. However, if the design objective is circuit availability and ease of maintenance rather than reliability, the additional surface required should not exceed 30 percent in most cases.

Several self-testing techniques exist today. One (the most costly in terms of surface but also the one yielding the greatest reliability) consists of duplicating the circuit. It is also possible to self-test at card level; this technique is rather common in the domain of memories, using special error detection and correction circuits, for example; but it too is costly in terms of MSI [medium-scale integrated] and SSI [small-scale integrated] circuits.

In the self-testing domain, it has been found that the integration of a self-testing function would be the best solution. This integration would pay off in terms of final production testing, which would be simplified, and maintenance, and would enable the marketing of standard circuits of high dependability.

#### A Self-Testing Error Detection and Correction Circuit Under Study

Although the manufacturers of memories and microprocessors are tending more and more toward integrating self-testing functions in certain of their circuits (the Intel IAPX 432 and the Mostek MK 4167, for example), there is as yet today no circuit on the market that is completely self-testing. However, studies in this domain are advancing at a fast pace, and France is far from being at the tail end



of the movement. The CNET [National Center for Communications Studies], which has already designed and built a 16 bit x 16 bit multiplexer capable of detecting its own failures and localizing them (this circuit was exhibited at ESSCIRC 80 at Grenoble last September), is now studying an error detection and correction circuit that is itself self-testing and capable of disconnecting itself in case of its own failure. This type of circuit is used to detect random errors in memories and is marketed by AMI [expansion unknown] particularly (see our 19 December 1980 issue).

Still as regards France, the EPCIS [expansion unknown] is studying a circuit that would centralize all the self-testing functions necessary for microprocessor systems, and the LAAS [Laboratory for Automatic Control and its Space Applications] is developing a completely self-testing circuit about which we have no other information. Intensive research is going on in the rest of the world as well, and many universities and companies--American and German--are devoting a great deal of attention to this field. Two self-testing circuits were exhibited at ISSCC 81 in February: an ROM [read-only memory] as part of a self-testing microprocessor by the Aachen Theoretical Electronics Institute (FRG), and a 16 bit x 16 bit multiplier by General Electric.

Siemens has developed a go/no-go test method that is applicable solely to logic circuits other than microprocessors, and Sperry Univac has described a circuit with one integrated self-testing function that enables isolation of failures in addition to providing a go/no-go test and is applicable to microprocessors. These latter two studies have not as yet been actualized in working circuits.

#### Self-Testing 16 Bit x 16 Bit Multipliers

A self-testing circuit, let us remember, is a circuit capable of signaling its own failures. This property is obtained, generally speaking, through the use of conventional techniques involving coding and massive redundancies. There are two self-testing methods: One is designated "on-line," in which the circuit is tested continuously during operation, and the other is called "off-line," in which the circuit is tested by means of a special sequence with generation of test signals and insertion of signature registers. In general, on-line testing is more costly in chip surface, although the opposite of this has also been encountered.

The 16 bit x 16 bit multiplier exhibited by the CNET at ESSCIRC 80 (it will also be shown at the meeting on new directions in integrated circuits to be held in Paris on 7 April) was chosen to support experimentation, on a realistic case basis--with respect to the feasibility of self-testing integrated circuits, since it contains a large variety of internal functions (registers, bus, arithmetic operations, automatic sequencing, etc.), while retaining a reasonable size (13 mm<sup>2</sup>, 1,600 gates, 5,000 transistors). This multiplier works on the basis of words of 16 bits encoded in the binary number system in two modes: a parallel mode in which it functions typically as a microprocessor peripheral, and a series mode. It is "simple self-testing" on line, meaning that all simple faults, during normal operation, will cause at least one error detected and signaled by the circuit



itself. Certain errors may not be detected, but every fault will produce an alarm signal. This circuit was built using NMOS [n-channel metal oxide semiconductor] technology based on a silicon grid with 6- $\mu$ m rulings. It consumes 300 mW and operates at 4 MHz (it completes a multiplication in 4  $\mu$ s). The additional surface required for self-testing is 25 percent of the total surface, to avoid an excessive increase in the number of case leads as well as in the size of the circuit. Some faults have not been taken into account: These are mainly those that can affect the E/S pins, but not the bus.

The self-testing property has been obtained by the use of parities and enables the casting-out-nines check. The parity of each intermediate result is checked using parity of the multiplicand, the nature of the intermediate operation controlled by a Booth algorithm, parity of the preceding intermediate result and parity of the results of a parity check performed in the adder. Parity of the multiplier is calculated from the circuit outputs based on the Booth algorithm, and the result obtained is compared with the parity received during the reading. This enables the testing of the multiplier, the Booth circuit and a goodly portion of the sequencing of the operation. Other functions are self-tested using local duplications.

The 16 bit x 16 bit multiplexer described by General Electric at ISSCC uses the same principle of arithmetical coding with parity provision for on-line self-testing. General Electric also uses an off-line method which requires more surface because of the need to generate the operands, and calculates a 19-percent increase in transistors in this case (16 percent in the on-line case).

#### A Self-Testing ROM

The Aachen Theoretical Electronics Institute (FRG), which is among those experimenting with self-testing procedures for microprocessors, has built a self-testing device involving a microprogramed register, a microinstruction register and an ROM responsive to the microprogramming. The test patterns and the responses evaluated in an off-line unit are generated on the multiple-access signature-register chip. The German researchers calculate at 15 percent the additional surface needed for the self-testing hardware required to build "a completely self-testing microprocessor. A 15-percent increment is needed for a K-octet ROM, and the additional needed surface diminishes as the storage capacity increases.

9399

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## ELECTRONICS

### THOMSON-CSF INTRODUCES PROTOTYPE OF BIPOLAR MOS

Paris ELECTRONIQUE ACTUALITES in French 3 Apr 81 p 47

[Article by J.P. Della Mussia]

[Text] The Semiconductors Division of Thomson-CSF will exhibit at its Salon stand a power-handling component prototype which is probably the forerunner of what could be a new generation of top-of-the-line power-switching components in the range between 10 A and 100 A at between 100 V and 400 V. It is the BIPMOS [bipolar MOS [metal oxide semiconductor]], which combines in a single conventional capsule a bipolar transistor chip, a VMOS [vertical MOS] chip in Darlington configuration to drive the former, and a Zener-diode storage-dump chip like the one found in all bipolar Darlington, but which here has the role of protecting the MOS. This MOS-plus-bipolar combination combines the basic advantages of the MOS and bipolar types of construction, namely, very high input impedance from the MOS standpoint and low cost per switched ampere from the bipolar standpoint. Its price would fall somewhere between those of the two types. The Darlington configuration was chosen in preference to the cascode configuration because, according to Thomson-CSF, the former would be fully integratable at a later stage.

The prototype introduced by Thomson-CSF can switch, below 100 V: 10 A in 60 ns [nanoseconds], 20 A in 180 ns, or 40 A in 400 ns. It is a sufficiently fast component, therefore, for tomorrow's, if not also day-after-tomorrow's, applications. Series voltage drop does not exceed 2 V below 30 A or 2.5 V below 40 A. This would be inconceivable under actual operating conditions (at 90°) with an MOS alone unless it were a model priced at Fr 400. If the BIPMOS being exhibit were marketed, its initial price in the hybrid version would be of the order of Fr 50-100...with the further advantage that high levels of drive would not be necessary, since the MOS in the BIPMOS is a low-power, hence low-input-capacity, model.

Thomson-CSF has designed its first BIPMOS prototype for 100 V (a 16-mm<sup>2</sup> D-MOS [Darlington-MOS] chip plus a 30-mm<sup>2</sup>, high-production-yield bipolar chip, that of the conventional BUW 38), since it was based on components available in the company's laboratories. There is, however, nothing to prevent the designing of the same structure for operation at 400 V, using a 400 V/2 A MOS and a 400 V/10 A BUX 48, for example, possibly in a 4-pin capsule, for greater flexibility of drive.

If it were desired to build a 400-V/10-A switch today using power MOS's without exceeding a voltage drop of 2 V at 100° C, either 4 top-of-the-line models (at Fr 400 each) or 8 of the best currently available cost/ampere-compromise models (chip surface of the order of 16-20 mm<sup>2</sup>) would have to be arranged in parallel. Now, aside from the cost aspect, anyone who has had to deal with connecting MOS's in parallel would rather not have to deal with this problem again... We emphasize in this regard that this problem is not one arising from a lack of MOS production know-how on the part of the manufacturers. MOS's have their physical limitations. In our opinion, it is highly unlikely that the industry will be able to improve, within the next 3 years, on a compromise that we would estimate to be as follows (prices based on large quantities): 400V/0.6 ohms (at 60° C): Fr 15 (chip surface of the order of 20 mm<sup>2</sup>); or 400 V/0.3 ohms (at 60° C): Fr 70 (chip surface of the order of 36 mm<sup>2</sup>); or even 100 V/0.06 ohms: Fr 15; or 100 V/0.03 ohms: Fr 70. We have used a temperature of 60° C in this estimate because the resistance depends a great deal on the temperature and a better performance/price compromise could be obtained by increasing the case size and operating at 60° C. Moreover, within that time, perhaps capsules containing two or three low-priced 20-mm<sup>2</sup> MOS chips will be introduced to compete with top-of-the-line single chip models. However viewed within this context, the BIPMOS would still come off best for all currents exceeding 30 A at less than 100 V, and exceeding 4 A at 400 V.

There exists, nevertheless, a component that is even better suited to driving bipolar transistors than the MOS: the IC [integrated circuit].

The fact is that the BIPMOS was created to provide easy driving of the bipolar transistor. However, this drive can be made even easier, and at the same time provide protection of the transistor, if its inherent characteristics are improved by replacing the MOS with a special-purpose IC. The IC-plus-bipolar association thus provides even greater flexibility of use and leads to a much lower price per switched ampere than those resulting from the use of the MOS. Thomson-CSF has in fact recently started producing such IC circuits (see our 13 March 1981 issue).

A "BIPCI [bipolar integrated circuit]," however, which would combine an IC chip and a transistor chip, is not likely to be brought into existence, since low-signal-level circuits cohabit incompatibly with high-power-level circuits.

Although IC's provide the best solution to driving transistors or Darlington's (eventually, even MOS's), they nevertheless have a circumstantial shortcoming: Since there must be a specific circuit for each possible type of application if configurations are to remain simple, the manufacturers must actually create entire families of drive circuits. Now, the manufacturers of bipolar transistors are rarely also manufacturers of IC's, and even in cases where they are, the production plants and their managements are different. As a result, only Thomson-CSF offers, as of today, two (and only two) circuits that are truly of this type.

It must also be noted that, generally speaking, IC's cannot, other than exceptionally (using the Moose NS process), be made to provide more than a few amperes, which could be insufficient to drive high-power transistors or Darlington amplifiers. The BIPMOS therefore has its reason for being, the more so since it is in the form of a single component that moreover could eventually be driven by an IC.

## ELECTRONICS

### BRIEFS

SIEMENS OPENS NEW VLSI PLANT--The currently most modern manufacturing facility in Europe for highly integrated circuits has gone into operation in Villach, following a construction time of just under 1 year and with a capital expenditure of 380 million schillings (DM 50 million). MOS [metal-oxide semiconductor] circuits are being made by VLSI [very-large-scale integration] processes. With these new products, technology in Austria is undergoing a great qualitative "leap forward." The manufacturing program of Siemens Components Partnership provides for semiconductor storages with 16-K RAM [random-access memory] and 64-K RAM capabilities. [Text] [Cologne ONLINE in German No 1-2, 1981 p 32] 12114

CSO: 3102/234

## ENERGY

### FRANCE CLAIMS TO BE WORLD LEADER IN GEOTHERMY

Paris LE FIGARO in French 3 Apr 81 p 11

[Article by G.B.]

[Text] "France leads the world in geothermy. I shall be accused of chauvinism, of being out to catch votes. This does not bother me. What I have said is the truth." With this terse statement, Minister of Industry Andre Giraud submitted yesterday his report on geothermal operations in France.

There are 15,000 lodgings in France, particularly in the Paris region and Aquitaine, now being heated by geothermy. Soon, 70,000 more lodgings will be connected to these sources of hot water issuing from within the earth. The state decided to set the example: The Air Force base at Mont-de-Marsan has been heated in this manner since 1977 and that of Creil should soon go over from fuel to this renewable energy source. This translates integrally into oil and gas savings. To Andre Giraud, the objective of heating 1 million lodgings by geothermy, thus saving 1 million tons of oil equivalent, appears "realistic."

#### The 10-Million Franc Hole

Since 1970, the date of its first important success at Melun, France has proceeded at double quick time. Numerous experiments, above all, between 1975 and 1978, have made it possible to develop new techniques while setting up the appropriate financial and regulatory frameworks.

A geothermal operation can in fact not be undertaken lightly, as the cost of a well to serve a minimum of 1,500-2,000 lodgings comes to over Fr 10 million. The viability of the project is based on the long term rather than the short. On the other hand, there is never the certainty, during the drilling of the hole, that hot water of the desired flow and temperature will be found. There have been total failures, as at Beaumont, south of Clermont. Furthermore, the intervention of many interested groups--those involved in the heating industry and occupations, the Mixed Economy Company, the municipal administrations, the tenants--constituted additional hurdles to be overcome to get geothermy under way.

From this point on, technical progress will consist either of developing sets of two holes, one for production of hot water and the other for reinjection of the cooled water into the same well (this system would enable the recycling of

the water and maintenance of the pressure inside the deposit), or the drilling of deviation holes. It has also been found necessary to resolve the problem of corrosion of the metals by the hot fluid, which is generally highly saline.

Also from this point on, the geothermal operations, carried out until now through the initiative of the state public works staff, can be taken over by the Bureau of Geological and Mining Research or the Geochaleur Company. The state has also modified the nature of its financial intervention: Instead of advancing 80 percent of the cost of the first hole, it subsidizes 30 percent of the total cost of the operation and assumes 50 percent of the risk.

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CRO: J102/240



## ENERGY

### ADRANO SOLAR POWER PLANT NOW OPERATING

Messina GAZZETTA DEL SUD in Italian 16 Apr 81 p 1

[Article by a.a.: "Adrano Power Plant Inaugurated--Solar Electricity in the Italian Network"]

[Text] It is the world's first tower and mirror-field installation. It has been built within the EEC framework by an Italian-French-FRG consortium. Ansaldo and the ENEL (National Electric Power Agency) represent Italy in it.

Rome--Yesterday for the first time in the world, at Adrano in Sicily, electrical energy produced by the sun was put into an electric-power network: at 1415 hours, the Adrano solar power plant (named "Eurelios")--the world's first tower and mirror-field power plant--was connected to the ENEL network.

The installation, which has a power of 1 megawatt, was completed in December 1980, and in the first month of 1981 had passed all its preoperational tests and had had the necessary final adjustments.

The Adrano power plant has been built within the framework of a European Community research program and through Italian-French-FRG collaboration.

The plant was designed and built by an industrial consortium to which Ansaldo and the ENEL belong, for Italy; Cathol, for France; and for the FRG, Messerschmidt-Bolkow-Blohm.

The power plant is the property of the ENEL and in the EEC [as published]; the ENEL is also responsible for operation and experimentation.

The construction of the power plant involved considerable research and development activity and required the working-out of new solutions; indeed, since it is the first installation of this kind, there were no terms of reference on which to base it.

The success of the undertaking does honor to the commitment and competence of all the partners. The contribution of the Italian members has been especially notable. Ansaldo, which in addition to building the turbine, the alternator and the electrical system, constructed the boiler, which is one of the technologically most advanced parts of the installation; for the boiler, Ansaldo made use of the work of the late Professor Francia and the results of the experiments conducted by him in the experimental plant of Sant'Ilario.



The ENEL, in addition to its membership of the consortium as codesigner of the installation, working out in particular the regulation of the solar boiler and of the thermal cycle, made the choice of the site and prepared it.

The experience that will be acquired with the Adrano power plant will be of great importance both for expanding knowledge of this type of installation and for acquiring greater capacity to evaluate their development prospects.

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## ENERGY

### METHOD FOUND FOR PHOTOLYSIS OF WATER TO PRODUCE HYDROGEN

Palermo GIORNALE DI SICILIA in Italian 23 Apr 81 p 7

[Article: "Hydrogen from Water Will Compete with Gasoline"]

[Text] Milan--In future it will be possible to obtain hydrogen from water in such quantities as to make it industrially exploitable as a fuel. The research center of the SIBIT (the Italian Titanium Dioxide Company, of the Montedison group) has in fact developed a catalyzer based on titanium dioxide, which, under the effect of light and in the presence of a particular compound called a sensitizer, dissolved in an aqueous system, is capable of causing the decomposition of water into hydrogen and oxygen, with sufficiently high speed--an obstacle which until now had blocked progress in laboratory research.

The process, developed jointly by the SIBIT research center of Spinetta (Alessandria), the Analytical Chemistry Institute of the University of Turin, and the Physical Chemistry Institute of the federal Polytechnical School of Lausanne, is a good example of collaboration among experts in different fields: experts in photochemistry and photocatalysis from the two universities, and experts from industry in the chemistry and physics of colloids in general and of colloidal titanium dioxide in particular.

The results obtained from the joint research are the first concrete achievement with high yields, on the laboratory scale, of the process of decomposition of water with the use of sunlight. The obtaining of hydrogen by this method--the subject of a great many studies in recent years--represents in all probability the most useful form of conversion of solar energy, since hydrogen itself is an ideal fuel from the ecological point of view, because in burning, it produces only water.

The SIBIT is producing more than 50,000 tons of titanium dioxide per year, and carries out very advanced research on that mineral.

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## ENERGY

### EXPANSION OF DISTRICT HEATING GAINING NATIONAL FAVOR

Hamburg DER SPIEGEL in German 13 Apr 81 pp 53-67

[Excerpts] If the Germans used the waste heat from industry and power plants for heating, they would be rid of a large part of their energy worries. And since an expansion of the district-heating system would create jobs, Bonn's top political figures are showing an interest in this heating method. Up to now, the managers of the power stations have been blocking this district heating.

"The matter is quite simple," Wolfgang Prinz, director of the Flensburg Public Utilities, informs his visitors, "in Flensburg we are warming our living rooms with that which the others are heating their air and their rivers."

Nine tenths of all the households in Germany's most northern city--which up to now has been known mostly for its run, its central index of traffic offenders, and Beate Uhse--draw their 600 megawatts of heating energy from the waste heat of the 120-megawatt electric-power plant at the inner harbor here which is deep enough for seagoing ships. And, according to Prinz on 4 February 1981, in speaking at the "Flensburg Days" in Bonn, "we have a compulsory hook-up requirement in our city, but we have not had to compel a single customer."

Since the time that Prinz was able to present his "Flensburg model" in Bonn, politicians and electric-power plants have left off representing district heating as an exotic alternative. Almost over night, using the waste heat of power plants and industry, also called combined heat and power generation, [cogeneration], has become a great hit.

Federal Chancellor Helmut Schmidt was now speculating publicly that district heating is suited as much as anything else as a basis for a sensible economic policy program. Other cabinet members as well, hitherto tightfisted with expenditure decisions, let themselves be won over for the utilization of waste heat from power plants. Because on the one hand, district heating fits in with the energy conservation program, and on the other hand it creates jobs.

Even the chancellor's nuclear-power man in the research ministry, Andreas von Buelow, has revealed his sympathy for this, and suddenly he now wants to "greatly expand" cogeneration.

SPD economic spokesman Wolfgang Roth has incorporated the district-heating concept in his proposals for future structural programs. Saarbruecken's chief

mayor, Oskar Lafontaine, paid a visit to Prins in Flensburg and now he as well wants to develop a district-heating supply system for Saarbruecken.

The Land Government of North Rhine-Westphalia has supported a joint memorandum by Ministers Parthmann and Jochimsen--who hitherto were in conflict on energy matters--which has made the development of cogeneration into the focal point of the entire North Rhine-Westphalia energy policy.

Hamburg's Senat, whose district-heating plans have been overshadowed by the Brokdorf debate, increasingly is pressing the municipal electric-power producer HAW (Hamburg Electricity Works) in the direction of district heating, because this--according to Senator for Financial Affairs Juergen Steinert--"is completely independent of Brokdorf."

Even the reactor builder KWU (Kraftwerk Union), a Siemens subsidiary, recommends getting into district heating by way of the so-called island strategy: To have municipal district-heating supply systems developed autonomously by the communities, and later to unite these into a common "district-heating transmission system."

The Munich physicist Pitter Graeff appeared on the Bremen talk show "Ill nach Neun" and told the public that the waste heat which was escaping into the air and water was sufficient to heat all the German cities, but even experts had never been willing to believe that: "And then I told the facts to one quite famous expert, who considered all this impossible. After 5 minutes of calculating, he believed it."

That is, the utilization of waste heat from power plants and industry brings such astonishing economic and ecological advantages that the erstwhile anti-district-heating lobby of the electric-power and oil companies is unlikely to come up with any arguments which could not be refuted by the reality of the Flensburg example.

#### Cogeneration:

- decreases the sulfur dioxide contamination in the air, since all the private-sector oil and coal smokestacks are eliminated,
- reduces the heating up of water bodies, because the waste heat is brought into the households,
- assuming a thorough-going application, decreases the FRG's oil dependence by 30 million tons or DM 10 billion, which represents 64 percent of the West German deficit in the balance on current account,
- raises the efficiency of the coal used in the power plant from 38 percent to over 80 percent,
- results in at least 350,000 new permanent jobs,
- reduces the heating bill for private households by four-digit figures vis-a-vis oil or gas heating.

The heat and electric-power plants for combined power and heat generation, which are always only intermediate in size, offer in the long run yet another environmental advantage: They can be combined with the so-called fluidized-bed furnace, which thus reduces their pollutant emission to about a tenth compared to present power plants--and reduces it to the less environmentally harmful substance.

With the fluidized-bed systems usual at present of up to 30 megawatts of boiler output, noxious sulfur dioxide is neutralized through injection of lime. The two substances combine to make calcium sulfate, which falls out through a boiler grate.

Moreover, the combustion takes place at such low temperatures that even hardly any dangerous nitrogen oxides are generated. Only carbon dioxide leaves the smokestack of a fluidized-bed system--but this can be assimilated by plants in a natural fashion.

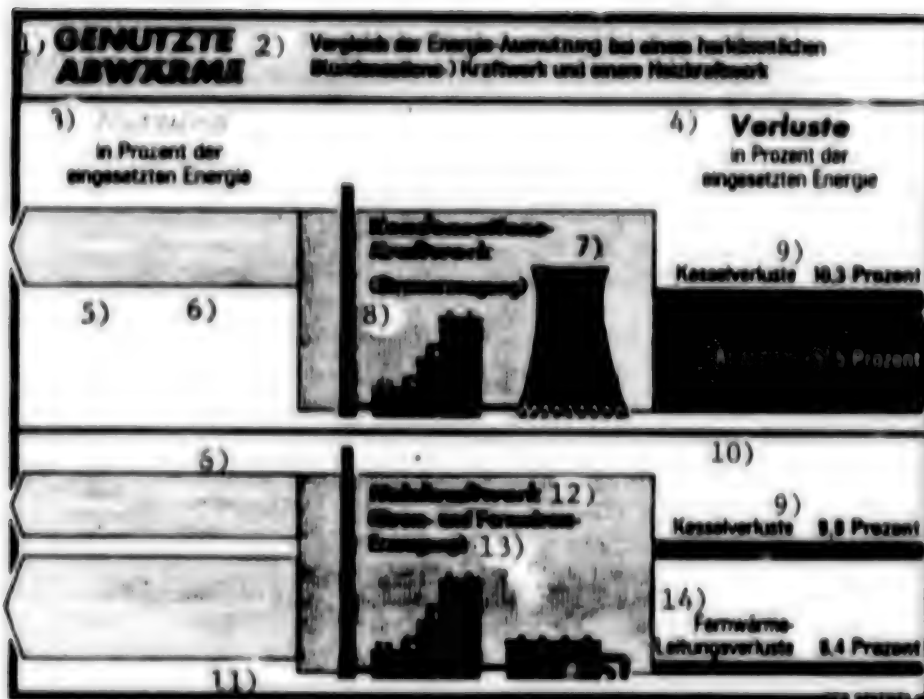
Consequently, heat and electric-power plants with fluidized-bed boilers maximize the efficiency of the coal used and minimize the overall environmental pollution. They need only a little more coal than what is needed for electricity production alone. And aside from these quite practical advantages, combined heat and power generation offers as well an ideological advantage: The nuclear-power debate can be deferred.

Whereas, in a district-heating study, Dieter Haak, a member of the energy commission associated with the SPD Executive Committee, was no less than jubilant in saying that this represents "a boost to community energy planning," practitioners such as Prinz have known for a long time, from the Flensburg experience, that nothing can be accomplished without the backing of the large power suppliers which dominate the nationwide electric-power grid system.

That is, in this respect the Flensburg model is not a model. It has the prerequisites for a well-ordered combined heat and power generation which are uniquely satisfactory in a political more than a technical sense. Only a few community power plants in the FRG are as independent as this fjord city's power plant is of electricity ~~monopolies~~ like RWE (Rhine-Westphalian Electricity Works, Inc.), VEW (United Westphalian Electricity Works), or NKK (Northwest Germany Power Plants).

The Flensburg Public Utilities have been working together for over 50 years with the Danish interlinked cooperative power-supply system of Elsam, which is less centrally organized than the German electricity companies. All of Elsam's partners in Danish cities have been engaged in combined heat and power generation for a long time now. Prinz: "Therefore our knowledge and understanding about supplying district heating is considerable."

Berlin native Prinz, now 49, had gotten involved with Scandinavian experiences of this sort some 12 years ago in Flensburg. In Finland, this graduate engineer had learned that even in sparsely populated regions, district heating can be employed on a large scale if it is done imaginatively and economically.



Key to Figure 1:

1. Utilized Waste Heat
2. Comparison of the energy utilization for a conventional (condensation) power plant and a heat and electric-power plant
3. Utilization in percent of energy made available
4. Losses in percent of energy made available
5. Percent
6. Electric energy
7. Condensation power plant
8. (Electricity generation)
9. Boiler losses
10. Waste heat
11. District heating
12. Heat and electric-power plant
13. (Electric-power and district-heating generation)
14. District-heating line losses

There in the far north, every third house is heated with district heating. In the capital of Helsinki, the share held by district heating is around 70 percent by now, and this is supposed to rise to 90 percent. Prinz learned that in Denmark even single-family dwelling areas, such as, for example, Aabenraa and the city of Odense, the birthplace of [Hans Christian] Andersen, can be heated almost entirely by district heating.

Therefore back in 1969 Prinz proposed a plan to the Flensburg municipal council for a combined heat and power generation system. Although at that time crude-oil prices were about 10 percent of their present level, Prinz backed imported coal because of "the long-term threat of an oil shortage," and he succeeded in getting this.

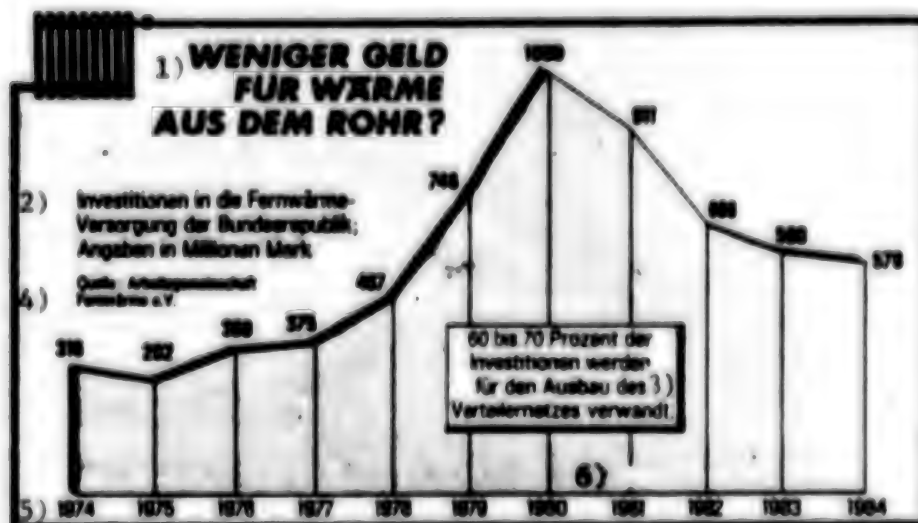


Quite soon, Prinz wants to expand his supply system also into the neighboring communities of Harrislee and Gluecksburg, and even include a Danish border community.

All told, Prinz has invested DM 350 million in Flensburg. Based on current prices, he would have had to budget DM 500 million. Of this sum, 45 percent went into electricity generation and 45 percent into heat generation, and 10 percent went into the power distribution. According to Prinz, the extra amount of coal needed for the heat generation is "insignificant." He has his coal docks right next to the power plant: "Incidentally, I am also the harbor director."

Thus, district-heating customers of the Flensburg Public Utilities are paying half as much for heating costs as those for gas heating or an oil system, at present. And then on 1 April 1982 the municipal gas works will be shut down as well, with the approval of Schleswig-Holstein's economics minister, Juergen Westphal.

"If you extrapolate the Flensburg case," calculates Prinz, "you can supply 50 percent of the FRG with district heating"--a program of several hundred billions of marks. But in fact Flensburg is not overestimated, but rather underestimated, in even the particularly optimistic experts' findings.



Key to Figure 2:

1. Less Money for Heat From Pipes?
2. Capital expenditures for supplying district heating in the FRG, figures in millions of marks
3. 60 to 70 percent of the capital expenditures are used for the development of the distribution system
4. Source: District-heating Association, e. V.
5. Actual
6. Projected



In a study by the Federal Research Ministry, which canvassed all the German regions as to their suitability for being supplied with district heating, the city of Flensburg is valued at a maximum of 347 megawatts of district-heating potential in the year 1990. When this study appeared in 1977, Prinz had already exceeded this value.

In the FRG as a whole, according to the study of the ministry, 25 percent of all space heating needs can be covered suitably by district heating. The District-heating Association, which is financed by the Association of German Electricity Works (VDEW), also goes as far as this maximum value.

On this basis, the Land Government of North Rhine-Westphalia is looking at about 29 percent as the upper limit in its own territory, but in the Ruhr area, with its dense population, its many factories and power plants, this limit is about 50 percent.

The power-plant builder KWU itself assesses the value of district heating so high even that it concedes to it a savings of about 20 million tons of hard coal units (about 14 million tons of oil).

According to SPD energy expert Dieter Haak, in all calculations on the potential for district heating it should be kept in mind "that the estimates made up to now of district-heating potential have been calculated on the basis of old oil and gas prices. From today's viewpoint, the effects mentioned...are probably a great deal larger."

The interest group VDEW, in which the large electricity producers call the tune, is alone in wanting the scope of district heating reduced to a middling 11 percent of the heating market. On the other hand, 31 percent of the market is to be reserved for the thermodynamically uneconomic electric heating. To that end, the FRG would need about 60 nuclear power plants. With combined heat and power generation, additional power plants would scarcely be necessary.

Haak thus suspected that the large power plants have "no basic interest in waste-heat utilization." And that this is the case has been demonstrated again and again during the last 20 years by the Hamburg Electricity Works, which is 72-percent controlled by the city of Hamburg. Certainly this was true long before the quarrel about Brokdorf.

More even than the electricity producers, the gas people--behind whom stand the funds of the great oil companies of Esso, Shell, and BP (British Petroleum)--are struggling to keep matters from getting out of hand concerning district heating. In the case of Moers on the Rhine, they have even managed to construct a natural-gas pipeline parallel to the district-heating line which was laid there.

Although the experts have been able to observe the Flensburg example for a number of years now, enthusiasm for expanding district heating has remained slight in the FRG for a long time.

Aside from that fjord city, so far only the Upper Rhine industrial city of Mannheim has begun to build an impressive district-heating supply system. By means of district heating, Mannheim's power-plant manager, Hans Peter Winkens,

intends to save 200,000 tons of fuel oil and thereby DM 120 million of foreign exchange annually and to create 1,500 new jobs. By now, about half of Mannheim's heating needs are being met via combined heat and power generation.

In Berlin, the municipal outfit of Bewag (Berlin Electric Power Works Corporation) wants to invest about DM 500 million in the development of a district-heating supply system. The Munich Public Utilities want to set up a fluidized-bed combustion system. Frankfurt and Nuernberg are developing their supply systems.

In the Rhineland, the Niederrhein outfit is beginning a district heating system with a heat transmission line by the river, which is to branch out into this sparsely populated region. And the Volkswagen city of Wolfsburg had gotten fitted early on with a district-heating supply system by its National Socialist planners.

All the same--this is what the Ueberhorst Commission recognized in its findings--combined heat and power generation is being used more in the FRG than in other industrial countries. That it has not been used even better has been due in part to the lack of readiness of the public utilities to redirect electric power from industrial production. However, in an arrangement between the VDEW and the Association of Power-production Industries (VIK), this brake was removed in 1979.

On the other hand, CDU experts in particular are bringing forward reservations about the financial expense for an extensive system of combined heat and power generation. But so far there have not been any detailed calculations on how much it would cost for an expansion of the district-heating capacity to even only 25 percent of the heating demand. The figures range between DM 25 billion and DM 100 billion, the savings in oil expenditures between DM 3 and 5 billion annually.

However, such figures have not been offset by private-sector capital expenditures which would have fallen due anyway because of obsolescence of existing heating systems, and in any case by impending capital expenditures for renovations of old power plants.

Likewise, the costs for and the effect of other energy-conserving measures, such as those for thermally insulating existing buildings, are left unconsidered. These alone can lower the space heating requirements by as much as a half. At the end of the trail it may turn out that much less of a capacity for heat and electric-power plants is needed than is now conjectured--and thus, less nuclear power plants as well.

CDU deputy Lutz Stavenhagen, a member of the Inquiry Commission and a person who is solicitous about the future of nuclear power, as a dedicated nuclear trailblazer, considers the financial expense for these energy-conserving measures to be intolerably high in general. In this connection, Stavenhagen is dealing with capital-expenditure totals of DM 200 billion by the year 2000.

But this horrendous figure loses its terrors if it is spread out over 20 years. Then it shrinks to DM 10 billion per year--about as much as two Brokdorfs would be likely to cost eventually. And, according to SPD energy expert Ueberhorst, this is "a fraction of the annual extra bill for oil."

## ENERGY

### BRIEFS

METHANOL PRODUCTION FOR CARBUROL--Elf-Aquitaine has now got several projects under way to produce dual-component fuel mixtures: essentially, to produce methanol, which, mixed with premium gasoline, will provide the first carburol. This company has signed an agreement with the Norwegian company Norsk Hydro for the purchase of 300,000 tons of methanol annually beginning in 1984. The methanol is to be produced from North Sea natural gas by a plant with a 600,000-ton/yr capacity. Elf-Aquitaine has also installed, near Lyon, a pilot heavy-raw-crude processing plant to develop methods of exploiting certain crudes from Venezuela and the Southwest of France, mainly through the use of petroleum coke. This residue can be gasified and used to produce methanol. Elf-Aquitaine is channeling another of its efforts into gasification of lignite, also to obtain methanol. It is currently negotiating with the EDF [French Electric [Power] Company] for the exploitation of EDF's Landes deposit. And, for the longer term, Elf-Aquitaine is looking into the gasification of imported coals. [Text] [Paris SCOOP ENERGIE in French 15 Mar 81 p 8] 9238

CSO: 3102/240

## INDUSTRIAL TECHNOLOGY

### BUBBLE MEMORIES USED IN AUTOMATED PRECISION MILLING

Paris INDUSTRIES & TECHNIQUES in French 1 Apr 81 pp 56-58

[Article by Andre Larane]

[Text] They arrive on their tiptoes, the magnetic bubble memories. Here is a French application of this component in CNC milling [computerized numerical control]. The manufacturer, Wirth and Gruffat of Annecy, wanted to improve the performance of its already-existing contouring milling machine intended for machine finishing in small series of pieces intensively worked by contouring and drilling.

The new version is on a par with the best Swiss or German machines, its manufacturer affirms. It is therefore normal that it includes an electronic system of the utmost refinement with a bubble memory. The latter has the advantage of enduring without difficulty the hostile environment of a shop. It is moreover non-volatile: it stores the data indefinitely, without needing batteries in the event the power supply is interrupted.

The last asset of this memory is not taken advantage of here: it concerns its capacity which nowadays reaches 128,000 characters. An account having been kept of the memory's price and his own needs, the manufacturer of the milling machine is satisfied with a capacity of 8,000 characters, of which 2,000 are used for the machine's functions. As an option, the client has the recourse of asking for 16,000 characters, or 14,000 usable. The storage of the program is on tape or cassette. Mr Garraud, of Siemens-Rhone-Alpes, has provided Wirth and Gruffat with the CNC. This model had been presented for the first time in Milan in October 1979.

The driving control measures the displacements of the axes through rotary sensors in increments of microns. The precision of positioning and repeatability are  $\pm 0.025$  mm and  $\pm 0.01$  mm respectively. Direct current motors with closed loop have been substituted for stepping motors of the previous model, from which there has been an improvement in performance. The output is 2 kW at 1,500 RPM for the 70/2500 RPM series, and 2.7/2 kW at 1500/3000 RPM for the other optional series of 400/4000 RPM. These low outputs are meant for small pieces. Also as an option, the vertical head is detachable: it is possible to work in horizontal milling. To speed up the changing of tools a "spindle stop" operates in 2.5 seconds at 4000 RPM.

In order to guarantee a perfect dynamic stability in all types of machine finishing and with all types of metal, the firm of Annecy has asked for structural tests at CEMMO [Center of Machine Tool Studies and Research]. The latter has undertaken experiments on the previous model as well as on the prototype, in order to eliminate vibrations altogether. Right now five machines are sold, two of them to Enertec-Schlumberger (Besancon). Mr Menestrier, of the office of precision mechanics studies, appreciates above all the machine's capability to construct delicate pieces, including many borings.

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## INDUSTRIAL TECHNOLOGY

### PROMOTION OF AUTOMATION IN INDUSTRY CONTINUES

Paris INDUSTRIES & TECHNIQUES in French 1 Apr 81 p 8

[Text] Within the framework of promoting flexible workshops by the CODIS [Committee for the Development of Strategic Industries], the automobile will be the first beneficiary of the measures announced at the end of the Council of Ministers meeting on 11 March. Substantial assistance will also be given to the two principal manufacturers for the development--in collaboration with Bertin, the SNIAS [National Industrial Aerospace Company], and Matra--of a vehicle consuming three liters per 100 kilometers before 1990. The Codis will also help French manufacturers of robotics and automatic equipment.

Some subsidized loans should encourage the investment of business, in particular that of the PMI [Small and Medium-Sized Industries]. Administered by Adepa [Agency for the Development of Automated Production], the MECA [Advanced Design Machines and Equipment--a new name for the numerical-control machine tools program of 1972] and APP [automation of production procedures] procedures will be extended to automatic machines as a whole and to all companies of less than 1,000 persons. They consist in subsidizing the purchase of initial equipment and in authorizing its return during the following 2 years in case of dissatisfaction.

In the coming months, Corem [Committee for the Coordination of Research Centers in Mechanics] will set up a branch office for "technological advice" in each region. It will have the mission of orienting the PMI toward technical centers and special laboratories.

Mechanics will also figure among the eight main themes of the 10-year plan of research. The allotted appropriations will affect first of all the wood network, the agro-alimentary sector, and instrumentation. However, the most original initiative is aimed at "promoting associated research": a financial incentive will encourage (the) industrialists to group themselves in order to make the universities and public organizations work.

The government has not forgotten education. Thanks to an operation analogous to that of "10,000 computers in the high schools," the technical (schools) will progressively equip themselves with small multi-purpose machine tools having a simplified numerical control. The minister of industry has pointed out that all



these actions correspond to a double stake for our country: to maintain the competitiveness of the manufacturing industry in the era of the microelectronic revolution; (and) to confirm our presence in this "considerable industry in the process of being born," that of automatic equipment. No one will complain to see mechanics finally taken into consideration. But, isn't it too little too late?

By all appearances, we have only retained the most spectacular aspects of this industry. The word "component" has not been uttered a single time during the presentation of the governmental plan, whereas therein lies our primary weakness. The robots we know how to build require many pieces that we must import from Switzerland or the United States.

As useful as it is, the generalization of the MECA procedures will not make us forget the relative failure of this operation: in spite of the undeniable advantages that it brings about, in 8 years only 400 PMI have profited from it.

Since most of the measures touching on research and training are still under consideration in the government departments concerned, their advertisement seems somewhat premature. Another cause for concern: Andre' Giraud has refused to figure precisely the cost of the government's financial participation. It seems that in many cases, the projects will have to be content with budgets and men already available.

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## SCIENCE POLICY

### 1981 SCIENCE, RESEARCH BUDGET OUTLINED

Duesseldorf VDI NACHRICHTEN in German 6 Feb 81 p 1

Text The financial leeway for science and research in the FRG is becoming more restricted. According to the draft of the federal budget, total state expenditures for education, science, research and cultural affairs of DM 12,261 million in 1981 are 3.56 percent higher than in 1980; this increase is considerably lower than that of the total federal budget, which, with expenditures of DM 224,600 million, is 4.3 percent higher than in 1980.

The cut in federal funds for the community project of university construction in 1981 (DM 680 million) compared with 1980 (DM 850 million) will have a noticeable effect; compared with last year's medium-range financial planning, the new federal plan for 1980 to 1984 allocates 30-percent lower expenditures, beginning in 1981. Expenditures for science, research and development outside the universities are to rise by 4.4 percent in 1981, almost as sharply as the total federal budget (DM 8,263 million compared with DM 7,918 million). The individual plan of the Ministry for Research and Technology (BMFT) is to increase by 5.2 percent, more than the total budget (DM 6,140 million compared with DM 5,836 million).

Cutting across departments, the survey of functions in the draft of the budget law shows the most important trends in expenditures for individual areas; expenditures for nuclear research are to rise by 9.2 percent to DM 1,973 million (1980: DM 1,806 million), those for other energy research by 7.6 percent to DM 709 (from 659) million. Expenditures for soil and marine research will rise particularly sharply--by 19.5 percent (from DM 272 million in 1980 to DM 325 million in 1981).

An 18.7 percent increase in expenditures for science and research and development (R and D) in the area of food, agriculture and forestry is planned (DM 270 million compared with DM 228 million). In the areas of social welfare, employment and health, expenditures will rise by 4.7 percent from DM 569 million to DM 596 million. Space research and technology show lower than average rates of growth (2.1 percent, from DM 792 to DM 809 million), as do R and D in the economy, including the infrastructure (1.6 percent, from DM 755 to DM 767 million) and also technological research and development (1.5 percent, from DM 467 to DM 474 million). Because the data processing program is coming to an end total federal funds for information and data processing will decline by 22.1 percent, from DM 190 million to DM 148 million.

In contrast to the financial plan of the previous year, medium-range financial planning--whose system is not in complete agreement with that of the budget law--shows a drastic increase in funds for energy as part of the program to support the economy: estimates are now for 1981: DM 3.37 billion (previous financial plan DM 2.7 billion), 1982 DM 3.19 (1.7) billion, 1983: DM 2.94 (1.2) billion, 1984: DM 2.72 billion.

Funds for science, research and development outside the universities are to continue to increase, but less rapidly than previously planned. The portion of R and D funds in the total expenditures of the federal budget is to increase slightly. The financial plan calls for the continuation of essential expenditures. Energy research and technology are in first place, although medium-term funds allotted to them will be reduced slightly compared with previous plans.

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## TRANSPORTATION

### BRIEFS

COAL DUST ENGINE NO ALTERNATIVE--The Ministry for Research and Technology (BMFT) explained in response to a delegate's question that "the coal dust engine is quite unlikely to be considered suitable for use in vehicles. We know of no projects which can be regarded as a realistic solution to the problem." In opposition to this view there is the opinion of the Association of Aircraft Suppliers and Rocket Industry (BLR) in Hamburg, which considers the use of these engines in power stations, ships and trucks to be possible. The BMFT stressed that the BLR had issued conflicting statements about the state of development in the construction of coal dust engines. The Association had referred to already developed competitive engines but had not been able to verify them. This contradiction had not been clarified by the BLR in spite of repeated requests. Even a symposium on this topic, announced for October 1980, did not take place. /Text/ /Duesseldorf VDI NACHRICHTEN in German 6 Feb 81 p 17 9581

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